forms. If this had been done in the first place, and the use of press copy books abandoned, there would have been little need for form revision in 1904, and the records would have occupied but one-fifth the space and the printing bill would have been less.

Still another inconvenience has persisted from former years; we still turn some pages one way and some another. And, furthermore, the pages are not bound side by side, as has been the standard custom for centuries, but many of the pages are joined end to end in a position much as in ancient times papyrus was unrolled. Even papyri were improved and paged or columned so that one section was next to another side by side for more ready consultation.

In the present form of our main record one has difficulty in selecting the time lines; he must use one page for a desk with its bottom jammed against the body, often soiling it, while he consults the page above, or, if consulting the lower page, he flops the upper into his ink well. And then, to give variety, when he consults a third, he must twist the whole volume about, scattering the trappings from his desk.

All of this is illogical and unnecessary. The records will be just as accurate and more handy and usable if all pages are arranged upright, bound side by side, and ruled with that consideration for the limitations of selection by distinguishing division lines at intervals. For date lines the marking interval might be based on either weekly intervals or in groups of five, and the vertical columns should be in groups of no more than 6, which would make 4 equal groups for the 24 hours. These latter rulings would then conform as well with the present rulings of automatic register forms.

While rulings are under discussion, we might as well consider the serial records of observations on pages 2, 3, 10, and 11 of Form 1001. For upwards of 60 years we have been entering the amount, kind, and direction of clouds all jumbled together; and to-day, when considering analysis of conditions above the earth, these records are practically useless unless recomputed. Just at the present we do record the predominant direction of the so-called upper and lower cloud levels, but we then ignore all the others.

Prevailing direction may be of some value, as indicating somewhat around the normal tendency, but so much of our scientific progress is made through study of the abnormal—the unusual—and searching for the related causes.

Except for the magnitude of its obscuration, quantity of cloud is of no great importance. What is of more importance is that cloud movement shows the trend of winds otherwise beyond our reach.

So it seems, since the various classifications of clouds indicate that many air layers, each should be recorded so as not to obscure the individuality of these layers. The present standard classification relates to about 9 levels and about 10 kinds of clouds if we separate cirrus from cirro-stratus clouds, which in nature probably are not so distinctly separated in movement. Nevertheless, for space taken in recording kind, direction, and for an unused blank there is found ample place to record separately each individual classification with its direction, as shown in a sample page of Form 1001 appended herewith.

Then, as well, we have need for the relative frequency from every direction. When each is in its separate column for classification and record of direction, it is then very easy to record the totals of the several directions, making summary of a complete record.

As to fog. Fog is perhaps of the same texture as stratus, and in an observation should not be ignored. On the other hand, it is believed no one ever heard of fog progressing against or across a wind. It always moves with it, and to record its direction is only to duplicate that made in another place by the wind vane. To count its surface direction amongst those of the lower clouds is only to vitiate the record we are making of winds above the earth. Its direction is of no importance.

Fog with haze and smoke, whether light or dense, may logically be recorded with state of weather at observation times; but from a consideration of its effect on both marine and aerial navigation, it should as well be recorded so as to show the period of continuance, and at no infrequent intervals the effect on visibility according to some standard scale. This would be a far more valuable record, both for current report and for future consideration from the summary of longer records. These effects on visibility are entirely worthy of a separate page for records of these elements. This record may well be developed from the experience of effects in our reporting for obstruction to navigation.

Permit me again to emphasize the necessity for arranging our record pages in logical position, with none upside down, crosswise or arranged in two-storied effect. Let's bind our books as the experience of the whole world has found most practicable since the inception of printing.

And, lastly, let us adhere to reasonable uniformity in our compilations. Let us not summarize, say, days of dense and light fogs one way in Form 1001, then another way in the means book. If it is necessary in one place to count as a day of light fog no day with dense, it should be uniform in both records. Neither should a day of snowfall as recorded in the summary of Form 1001 be one with 0.01 inch of melted snow and in the means book be one with 0.1 (one-tenth) inch unmelted, as makes the heading on page 29 of the latter. There may be other occasions of inconsistency that some of you recall. Let us eliminate them amongst ourselves before we betray these inconsistencies to the public, who are in increasing numbers consulting our compiled records.

TREE RINGS AND WHEAT YIELDS IN SOUTHERN SASKATCHEWAN

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This is the record of a study of radial tree growth at two points in southern Saskatchewan. The method followed is that set out by Dr. A. E. Douglass. A relationship is found between tree growth and wheat yields in southern Saskatchewan. Since crop records in this district go back only to 1898 and meteorological records go back only to 1883, the tree-ring chart, which goes back to 1763, is valuable in studying weather cycles which affect crop yields.

Most of southern Saskatchewan is a flat prairie with no trees. There are trees, however, in the eastern part and on Wood Mountain and the Cypress Hills in the west; but most of the old trees have been cut, and stumps rot so quickly that they can not be used for counting tree rings. There are also scattered clumps of trees near rivers and swamps. Trees from two such localities were studied. Eight cross sections of ash and one old elm were collected at the Trossachs grove 20 miles west of Weyburn in 1931.

Five samples of ash from Roche Percee, near the Souris River, were gathered the same year.

The time of felling of all the trees, except one at Trossachs and one at Roche Percee, was known. It was found by cross identification, however, that two of the trees whose date of felling was known had been dead for a year or two before being cut. The two trees whose dates of felling were not known were easily cross identified with the others, wide rings being found as valuable as narrow ones for this purpose.

Width of the rings was measured with an ordinary wooden ruler in centimeters by eye. The longest radius was used in each case for ease in measurement. The record from each tree was plotted separately on cross-section paper and cross identified with others in the group. The later years in some of the old trees showed small annual variations and were omitted, as they would have tended to smooth the curve. The average growth for each tree was then calculated. The percentage which each year's growth was of the average was then determined. These figures were averaged, making two graphs showing annual percentage variation of radial tree growth from the average, at Roche Percee and Torssachs.

A relationship between the two curves was found to to exist. One white spruce from Maple Creek was also found to have a relationship to the Trossachs curve. The Trossachs chart was then correlated with wheat yields per acre in crop district No. 2 (Regina-Weyburn) the coefficient being $+0.31 \pm 0.10$. Since the surrounding crop districts show relationship with crop district No. 2, this Trossachs curve shows to some extent crop conditions in southern Saskatchewan. Large discrepancies occurred in years when rust affected wheat, as in 1916, or where frost killed buds in trees, as in 1915, which was a bumper crop year, but a poor year for the trees. The Roche Percee curve showed no relationship to wheat yields in crop district No. 1, where Roche Percee is situated; however, Dr. O. C. Stine, of the United States Department of Agriculture, found that this curve shows a relationship to crop yields in North Dakota.

It was thought that since trees are perennial and wheat is an annual plant, there might be a lag in tree growth due to conservation of energy in the tree and soil moisture which the roots could reach. To determine the amount of this lag the Trossachs curve was correlated with the same series of figures for the previous year. r was $+0.58 \pm 0.03$. So the relationship is r or practically one-third. The chart was corrected by subtracting from each figure one-third of that of the year previous, and the revised curve correlated with wheat yields. The improved correlation, $r = +0.38 \pm 0.01$, justified the correction.

The charts were examined by several parties for cycles, but no small cycles were found to predominate. However, Dr. Dayton C. Miller, of Cleveland, Ohio, found evidence of a cycle of over 50 years, suggesting the 55-year weather cycle discovered by other investigators.

The conclusions from this study are as follows:

1. There had been enough moisture in southern Saskatchewan to grow trees for the last 150 years.
2. Extremely poor years have been the exception.
3. A relationship exists between tree growth at Trossachs and wheat yields per acre in southern Saskatchewan, improved by eliminating moist years which cause rust and cold years which are bad for tree growth.
4. A correlation exists between Roche Percee tree growth and wheat yields in North Dakota.
5. There is a relationship between tree growth at Roche Percee and Trossachs.
6. Roche Percee tree growth is not related to wheat yields in southern Saskatchewan; Trossachs tree growth is not related to wheat yields in North Dakota.
7. There is a carry-over of one-third of each year's tree growth to the next year due to the conservation of energy in the tree, or soil moisture, or both.
8. The only important cycle found was one of over 50 years.
9. Trossachs tree growth correlated with Qu'Appelle May–June rainfall (1884 to 1931) gave $r = +0.32 \pm 0.09$.
10. Lack of short cycles makes prediction of wheat yields from tree growth impossible.

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A REVIEW OF "THE STRUCTURE OF THE WIND OVER LEVEL COUNTRY"

[Meteorological Office Geophysical Memoirs No. 54, by the late M. A. Giblett and other members of the staff. Pp. 119, with 21 plates]

By G. GRIMMINGER

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This important memoir is divided into five distinct parts.

Part 1. Instrumentation and installation.—Dines pressure tube anemometers were mounted at the tops of four 50-foot towers, three of which were set at the corners of an equilateral triangle having sides of 700 feet, approximately the length of a rigid airship. About 3,500 feet away from this triangle there was a fifth tower 150 feet high at the top of which were mounted an anemometer and a recording electrical thermometer, thus making it possible to determine the vertical gradient of wind speed and of temperature at any time. The wind directions were recorded on Baxendall recorders. In order that the details of the fluctuations in speed and direction might be studied, open-time scales were used, the largest giving 1 inch of record in 42 seconds. An analysis is given of the instrumental errors in the speed and direction records.

Part 2. Horizontal fluctuations in wind in time and space.—The results of a statistical study of the records are discussed and some of the conclusions reached are as follows: During an adiabatic or superadiabatic gradient large, or major, eddies are present which vary in length (down wind) from 3,000 to 8,000 feet and in width (across wind) from 600 to 2,000 feet. These major eddies are characterized on the speed record by fluctuations of comparatively long period, each of which shows a sharp increase in speed followed by a gradual decrease. Imbedded in the major eddies are a large number of smaller eddies which are recognized on the speed record by numerous short period fluctuations superimposed on the fluctuations of long period. On the other hand, when a surface inversion is present there are no pronounced major eddies, the gusts being due mainly to the small scale eddies, which may also disappear if the inversion becomes strong enough. Some interesting records are included which show the sudden changes occurring in wind speed and direction during the passage of fronts and thunderstorms.

Part 3. A theory of eddies.—In this part C. S. Durst puts forward a theory to explain the two main types of